

MODERN MILLING OF SUGAR CANE

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CONTENTS.

CHAPTER XII

MILL ENGINES	225
------------------------	-----

CHAPTER XIII

ELECTRIC DRIVE OF MILLS	241
-----------------------------------	-----

CHAPTER XIV

MILLING TRAINS AND THEIR OPERATION	271
--	-----

CHAPTER XV

IMBIBITION AND MACERATION	311
-------------------------------------	-----

CHAPTER XVI

THE DIFFUSION PROCESS	333
---------------------------------	-----

CHAPTER XVII

JUICE STRAINING AND PUMPING	339
---------------------------------------	-----

CHAPTER XVIII

MEASURING OR WEIGHING OF JUICE	351
--	-----

CHAPTER XIX

MILLING CONTROL	367
---------------------------	-----

CHAPTER XX

GENERAL SURVEY AND CONCLUSION	396
---	-----

APPENDIX

DEFINITIONS CONCERNING MILLING TERMS

TERMS CONCERNING MILLING

CONVERSION TABLES

ENGLISH EQUIVALENTS OF METRIC MEASUREMENTS

COMPARISON OF CENTIGRADE AND FAHRENHEIT SCALES

DEDICATED
AS A TRIBUTE OF AFFECTION
TO THE MEMORY OF
MY FATHER
WILLIAM MAXWELL
MEMBER OF THE INSTITUTION OF MECHANICAL ENGINEERS
AN
ACKNOWLEDGED LEADER
IN THE APPLICATION OF ENGINEERING SCIENCE
TO THE CANE SUGAR INDUSTRY

CONTENTS.

CHAPTER I

THE MILLING STATION	1
-------------------------------	---

CHAPTER II

CANE UNLOADERS	10
--------------------------	----

CHAPTER III

THE CANE CARRIER	32
----------------------------	----

CHAPTER IV

CANE KNIVES	51
-----------------------	----

CHAPTER V

CRUSHERS	63
--------------------	----

CHAPTER VI

SHREDDERS	100
---------------------	-----

CHAPTER VII

THE CRUSHER-SHREDDER	111
--------------------------------	-----

CHAPTER VIII

PREPARATION OF THE CANE	123
-----------------------------------	-----

CHAPTER IX

MILLS	133
-----------------	-----

CHAPTER X

INTERMEDIATE CARRIERS	195
---------------------------------	-----

CHAPTER XI

THE GEARING	208
-----------------------	-----

Chapter I.

THE MILLING STATION.

Milling — Raw Material — Structure of Cane — Definition of Constituents — Proportion in Cane — Fibre — Juice — Typical Milling Plants — Machinery embodying the Milling Station.

In the factory, the process of making sugar out of the sugar cane falls mainly into two stages : —

- (1) The extraction from the cane stalks of the juice containing the sugar in solution.
- (2) The recovery from this juice of the sugar in the form of a commercial product.

The present volume will deal solely with the primary phase : the extraction of the juice from the cane.

Milling.—The operation known as the “milling” of the cane is carried out in what is called the “milling station” or “mill house” of the sugar factory. This department takes charge of the cane from the moment it enters the factory and extends to the juice scales, where the extracted juice is weighed before it passes on to the sugar house for treatment.

The essence of milling may be outlined thus — The canes coming from the field in carts or trucks are transferred by manual or mechanical means to the cane carrier, which feeds the milling plant. After undergoing a more or less intensive “preparation,” the disintegrated cane is subjected to repeated and heavy pressures exerted by slowly revolving rollers of powerful dimensions combined in units and arranged in a train. The bulk of the juice contained in the cane is thereby squeezed out, leaving a moist fibre, called “bagasse,” which has hitherto been used as fuel for the boilers. In order to obtain the maximum amount of juice (sugar) from the cane this purely forceful mode of operation is inadequate and must be supplemented by one of the processes known as “imbibition,” “maceration” or “diffusion,” which will be discussed in due course.

This standard process of extracting juice, as is practised throughout the cane sugar world, is essentially of a physical and mechanical nature, and accordingly belongs in the main to the province of engineering. The responsibility of its efficient working rests upon the Chief Engineer and his staff. This being so, we may confine ourselves in what follows to examining the cane and its primary treatment from the point of view of the engineer.

Raw Material. - Let us begin with the harvesting of the cane, as the methods thereof have to some extent an influence on milling. This occurs mainly in two ways. In the majority of countries the canes are generally cut close to the ground as low down as possible. Next, the tops and most of the trash are removed, and then the stalks are sent to the factory either whole or cut into portions of about 3 ft. (as in Cuba) or longer. In Java, on the other hand, where only "plant cane" is grown, the cane stools are dug or rooted out of the ground, so that the whole root bearing base of the cane is retained. Then the top, trash, roots and clinging soil are removed from each of the stems separately; the cane finally arrives at the factory in bundles of long, straight stalks usually over ten feet in length. To give a concrete case it may be mentioned that in a certain factory in Java the whole crop consisted of stalks averaging over $12\frac{1}{2}$ ft. in length and $5\frac{1}{2}$ lbs. in weight.

In some countries there is a good deal of fallen or "lodged" cane, which implies crooked or warped stalks. These take up superfluous volume on the cane carrier and consequently require a fair amount of preparation in order not to impair the capacity of the milling plant.

Cane stalks vary much in thickness. The diameter of commercial cane ranges roughly between half an inch (as with the native grown varieties in India and some of the Uba canes in South Africa), and two inches or more.

Structure of Cane.—From a milling point of view the cane consists of a more or less cylindrical stalk built up of a series of internodes (see *Frontispiece*), separated from one another by hard transverse partitions—the nodes. Its wall is made up of rind and its interior of pith. The pith is the soft, fibrous part of the cane and contains in its cellular structure the bulk of the juice. The rind is hard and tough, while the nodes are hard and woody.

The thinner the canes, the larger in general, the proportion of rind and the greater the resistance offered to crushing; the stouter the canes the



FIG. 1
A PARTICULARLY TOUGH CANE VARIETY.